

**Oroville Facilities Relicensing Efforts  
Environmental Work Group  
Draft Narrative Reports for Resource Action Discussion**

**Resource Action:** EWG-92  
**Resource Action:** EWG-91

**Task Force Recommendation Category:** 2  
**Task Force Recommendation Category:** 4

**Proposed Gravel Replacement for Enhancement of Salmonid Spawning Areas in the Low Flow Channel**

**Task Force Recommendation Category:** EWG-91 and EWG-92 have been combined into one Resource Action (Resource Action EWG-92). Therefore, EWG-92 has been recommended for *Category 2*, while EWG-91 has been recommended for *Category 4*.

**Date of Field Evaluation:** No field investigation has been conducted; however, detailed discussions occurred at the DWR-Red Bluff facility on July 28, 2003.

**Evaluation Team:** Richard Harris, Koll Buer, and Bruce Ross

**Description of Potential Resource Action:**

Supplement the low flow channel with gravel in the vicinity of spawning riffles, if the ongoing study plan (SP-G2) indicates these areas are found to be of poor quality for spawning. The ultimate goal is to increase the availability of spawning habitat for anadromous salmonids.

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-16A and EWG-16B, which propose enhancement of existing, or creation of new side channel habitat in the lower Feather River.
- EWG-19A, that would modify or create “benches” or floodplain surfaces in the lower Feather River.
- EWG-22, that would attempt to improve connectivity of the river with its floodplain in the lower Feather River by setting levees back.
- EW-89, that would set back levees to increase meandering nature of river and improve gravel composition in critical spawning reaches of the low-flow reach.

**Nexus to the Project:**

Lake Oroville prevents the movement of gravel from upstream sources to the lower Feather River. As a consequence of this, there is no significant recruitment of gravel that is of suitable sizes for use by spawning anadromous salmonids. Regulation of flows and scouring of suitably sized gravel from the low flow reach have further reduced the area of spawning habitat.

**Potential Environmental Benefits:**

The benefits of enhancing the available spawning habitat would include increased production of anadromous salmonids (salmon and steelhead). This in turn, could also potentially reduce the incidence of redd superimposition and genetic integression.

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**Potential Constraints:**

This is a measure that has been done in the past, particularly in association with improving Moe's Ditch as spawning habitat. The main constraint is keeping the gravel at the spawning sites, especially during occasional peak flow events.

**Existing Conditions in the Proposed Resource Action Implementation Area:**

Habitat for anadromous salmonids in the low flow reach of the Feather River has been affected by the disruption of natural geomorphic processes due to a myriad of causes including: historic hydraulic mining, historic and current land uses, the construction and maintenance of flood control levees, by the regulation of flow in the river, and by the presence of the dam creating Lake Oroville. The dam blocks sediment recruitment from the upstream basin from flowing into the lower Feather River. Levees, and more specifically, bank armoring, prevent gravel recruitment from banks, abandoned channels, mine tailings and floodplains. Periodic peak flows are of sufficient magnitude to winnow smaller-sized gravels from spawning riffles resulting in armoring of the remaining substrate. Much of the stream bed substrate in the low flow channel is composed of larger gravels and cobbles, which are too large for construction of spawning redds by the salmon and steelhead. Despite these constraints, the low flow channel is by far the most important section of the river for salmon and steelhead spawning.

**Design Considerations and Evaluation:**

Placement of gravel in the low flow reach could be accomplished in one of three ways:

1. Gravel could be introduced into the system in the vicinity of the diversion dam and allowed to migrate downstream.
2. Gravel could be directly placed at spawning riffles.
3. Gravel could be placed in the vicinity of naturally eroding banks, from where it would be transported downstream.

If options (1) or (2) were selected, water quality considerations would require that the gravels be washed before introducing them to the stream in order to prevent increased turbidity. Placing the gravels near naturally eroding banks (Option 3), might eliminate the necessity for washing the gravel, thereby potentially reduce costs to implement the Resource Action. This issue would require further evaluation.

It may appear more efficient to place gravels directly at targeted riffles. However, either introducing gravels at the top of the reach or allowing the gravels to erode from bank positions would probably still have positive effects. Additional information would be needed to determine the best approach for gravel supplementation. Gravel supplementation programs have been implemented elsewhere including the Sacramento River near Redding, the Mokelumne River below Camanche Dam, the Merced River below Crocker-Huffman Dam, and other rivers throughout the Central Valley. Evaluations conducted in association with those efforts can help in the choice of the optimal approach for the Feather River. For example, on the Merced River, gravel

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placement directly at spawning riffles did not provide lasting benefits because the gravel migrated downstream.

Under the current flow regime (regulated flows of 600 cfs), particles the size of spawning gravels are not flushed from the low flow channel. Spawning gravel transport occurs when periodic peak flows are between 30,000 and 60,000 cfs. Flows >50,000 cfs have occurred approximately 12 times since closure of the dam. Consequently, gravel placements would have to be repeated after peak flow events in order to maintain the benefits of this measure. Some changes to the flow regime (e.g., periodic pulsed flows) may be necessary to transport gravel to riffles from placement sites

If gravel is supplemented in the low flow reach and is moved downstream by peak flows, this could have positive downstream effects as far as Gridley. The gravel transported downstream could contribute to creation of geomorphic surfaces and point bar development. This would partly restore natural sediment transport processes in the river.

Data exist from SP-G2 on the amount of gravel that was transported in the Feather River prior to closure of the dam. These data could be used to design a gravel supplementation project that would be commensurate in quantity with the impaired flow regime.

Gravel placement could be benefited by the use of instream structures and LWD as proposed in EWG-13A and 13B. Instream structures placed at riffles could assist in retaining gravel and potentially enlarging spawning riffles.

Other approaches could be introduced to increase the availability of spawning habitat. For example, for years Moe's Ditch (near the hatchery) was managed to provide spawning habitat by gravel placement, however, this also proved to be only a temporary benefit. Each year the gravel migrated to the mouth of the ditch and had to be re-graded. That practice has been discontinued, and at the present time, Moe's Ditch does not provide any spawning habitat. Similar projects (i.e., artificial channels), while potentially only temporary, could be considered to provide additional spawning habitat.

**Synergism and Conflicts:**

Coordinating this measure with other measures aimed at improving gravel composition (through levee set backs (e.g., EWG-89)) and improving the quality of spawning habitat (e.g., EWG-18/90) would be beneficial. It would also be advisable to coordinate planning for changes to the flow management regime with planning for this measure.

There do not appear to be any major conflicts between this measure and other Resource Actions. The only potential environmental issue that would need to be resolved is water quality impacts from gravel placement.

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**Uncertainties:**

Uncertainties would depend on the option chosen for gravel placement. If gravel is placed at the top of the low flow channel or on eroding banks, there would be uncertainty that the gravel would actually reach and be retained at spawning riffles. The other major uncertainty is the length of time that recruited gravel would remain in the system and provide benefits. This can be minimized if the gravel placement is viewed as a continuing process rather than a one-time treatment. Providing annual gravel supplements equal in quantity to what natural recruitment might have been, adjusted for the regulated flow regime, could provide benefits far beyond the low flow channel.

**Cost Estimate:**

Detailed costs cannot be estimated because of the conceptual nature of this measure. However, the main source of cost will be heavy equipment operation. This cost is in the range of \$1,000-2,000/day. Additional costs would be incurred if gravels have to be washed prior to placement. It is assumed that gravels can be obtained at little or no cost from lands owned by DWR (e.g., Oroville Wildlife Area) perhaps in conjunction with other PM&E measures.

**Recommendations:**

This measure should be considered as a potentially viable solution for the lack of suitable spawning habitat in the low flow reach. However, any approach to supplement the stream channel with gravel would, if not done in conjunction with measures to transport and retain the gravels at the spawning areas, potentially provide only temporary benefits. Therefore, it should be considered in conjunction with Resource Actions designed to enhance gravel retention at targeted riffles (i.e. EWG 13A and 13B).

Further study would be required to determine: 1) what quantities of gravel should be placed; 2) where the gravel should be placed; 3) what modifications to the flow regime may be required to make the Resource Action work; 4) what, if any, instream structures should be used (and where) to enhance retention at spawning riffles; and 5) the feasibility of combining gravel placement with pond enhancement in the Oroville Wildlife Area.